

Claims

- [c1] 1.A process for producing halogen oxide, the process comprising:
feeding a dilute aqueous alkali metal halite solution into a cation exchange column, wherein the cation exchange column contains a cation exchange material;
contacting the dilute aqueous alkali metal halite solution with the cation exchange material to produce an effluent containing halous acid;
feeding the effluent containing halous acid into a catalytic reactor containing a catalytic material; and
contacting the halous acid containing effluent with the catalytic material to produce a halogen oxide.
- [c2] 2.The process according to Claim 1, wherein feeding the dilute aqueous alkali metal halite solution into the cation exchange column comprises flowing the dilute aqueous alkali metal halite solution at a flow rate of about 0.1 to about 0.2 bed volumes per minute.
- [c3] 3.The process according to Claim 1, wherein the alkali metal halite solution consists essentially of an alkali metal chlorite solution to produce an effluent containing chlorous acid from the cation exchange column, and chlorine dioxide upon contact with the catalytic material.
- [c4] 4.The process according to Claim 1, the cation exchange material is selected from a group consisting of strong acid polystyrene divinylbenzene crosslinked resins, weak acid polystyrene divinylbenzene crosslinked resins, iminoacetic acid polystyrene divinylbenzene crosslinked chelating selective cation exchange resins, synthetic inorganic cation exchangers and naturally occurring cationic exchangers.
- [c5] 5.The process according to Claim 1, wherein the cation exchange material has a crosslinking density greater than or equal to about 8%.
- [c6] 6.The process according to Claim 1, wherein the cation exchange material has a crosslinking density greater than or equal to about 16%.
- [c7] 7.The process according to Claim 1, wherein the cation exchange material has a

crosslinking density greater than or equal to about 25%.

- [c8] 8.The process according to Claim 1, wherein the dilute aqueous alkali metal halite solution contains less than about 10,000 milligrams alkali metal chlorite per liter of solution.
- [c9] 9.The process according to Claim 1, further comprising periodically regenerating the cation exchange material.
- [c10] 10.The process according to Claim 9, wherein periodically regenerating the cation exchange material comprises contacting the cation exchange material with a protic acid.
- [c11] 11.The process according to Claim 9, wherein periodically regenerating the cation exchange material comprises feeding an acid precursor solution into an electrolytic reactor comprising a compartment having an inlet and an outlet, an anode, a cathode, and a particulate material disposed between the cathode and the anode, wherein the particulate material comprises a cation exchange material applying a current to the electrolytic reactor to produce an effluent containing a protic acid and feeding the effluent containing a protic acid into the cation exchange column.
- [c12] 12.The process according to Claim 9, wherein periodically regenerating the cation exchange material comprises flowing a protic acid into the cation exchange column at flow rate of about 0.05 to about 0.1 bed volumes per minute.
- [c13] 13.A system comprising for producing a halogen oxide comprising, in combination:
an electrolytic reactor comprising an anode compartment comprising an anode, a cathode compartment comprising a cathode, and a central compartment positioned between the anode and cathode compartments, wherein the central compartment comprises a cation exchange material and is separated from the cathode compartment with a cation exchange membrane;

a cation exchange column comprising chamber having an inlet and an outlet, wherein the chamber contains a cation exchange material, and wherein the cation exchange column outlet is in fluid communication with a central compartment outlet of the electrolytic reactor; and

a catalytic reactor comprising a chamber having an inlet and an outlet, wherein the catalytic reactor chamber contains a catalytic material, and wherein the catalytic reactor inlet is in fluid communication with the cation exchange column outlet.

[c14] 14.The system according to Claim 13, wherein the cation exchange material has a crosslinking density greater than or equal to about 8%.

[c15] 15.The system according to Claim 13, wherein the cation exchange material has a crosslinking density greater than or equal to about 16%.

[c16] 16.The system according to Claim 13, wherein the cation exchange material is selected from the group consisting of strong acid polystyrene divinylbenzene crosslinked resins, weak acid polystyrene divinylbenzene crosslinked resins, iminoacetic acid polystyrene divinylbenzene crosslinked chelating selective cation exchange resins, synthetic inorganic cation exchangers and naturally occurring cationic exchangers.

[c17] 17.A process for producing chlorine dioxide from an alkali metal chlorite solution, the process comprising:

feeding a diluted alkali metal chlorite solution to a cation exchange column, wherein the cation exchange column comprises a cation exchange material disposed therein;

contacting the diluted alkali metal chlorite solution with the cation exchange material to produce a halous acid effluent;

feeding the halous acid effluent to a catalytic reactor to produce a halogen oxide; and

periodically regenerating the cation exchange material in the cation exchange column comprising:

applying a current to an electrolytic reactor, wherein the electrolytic reactor comprises an anode compartment comprising an anode, a cathode

compartment comprising a cathode, and a central compartment positioned between the anode and cathode compartments, wherein the central compartment comprises the cation exchange material and is separated from the cathode compartment with a cation exchange membrane;
flowing water into the anode compartment;
feeding an acid precursor solution to the central compartment;
exchanging alkali metal ions from the acid precursor with hydrogen ions to produce a protic acid effluent from the central compartment; and
periodically feeding the protic acid effluent into the cation exchange column to regenerate the cation exchange material.

- [c18] 18.The process according to Claim 17, wherein the acid precursor solution comprises an alkali metal compound selected from the group consisting of sulfates, sulfites, nitrates, halides, nitrites, and phosphates.
- [c19] 19.The process according to Claim 17, wherein the acid precursor solution comprises an alkali metal chloride solution, and wherein the effluent containing the protic acid comprises hydrogen chloride.
- [c20] 20.The process according to Claim 17, wherein the cation exchange material has a crosslinking density greater than or equal to about 8%.
- [c21] 21.The process according to Claim 17, wherein the cation exchange material has a crosslinking density greater than or equal to about 16%.
- [c22] 22.The process according to Claim 17, wherein the cation exchange material has a crosslinking density greater than or equal to about 25%.
- [c23] 23.The process according to Claim 17, wherein the cation exchange material in the cation exchange column comprises a different cation exchange material than the cation exchange material in the electrolytic reactor.